which copper deposition speeds both on the surface and inside microvia holes of the wiring board are optimum.

9. (Amended) The electrolytic plating device according to claim 8, wherein the stirring unit adjusts the flow rate of the copper plating solution to bring the iron ion amount present near to wiring board surface to a level at which all the microvia holes are almost fully filled and the plating layer thickness on the wiring board surface becomes optimum.

REMARKS

Status of the Application

Upon entry of this amendment, claims 1-11 are pending and stand rejected, and claims 1, 4 and 8 are also objected to. Claims 1-4 and 7-9 have been amended. No claims have been added.

In view of the foregoing amendments and the following remarks, Applicants respectfully request reconsideration of the present application and an early Notice of Allowance.

Objections of Record

The specification is objected to because of inadvertent informalities. Applicants have amended the paragraphs beginning at line 18 of page 6 and at line 3 of page 20 as requested by the Examiner, and therefore request withdrawal of the objection.

Claim 1 stands objected to because of an informality found at line 7, wherein the recitation "0. 1" is requested by the Examiner to be changed to "0.1". Applicants have amended claim 1 in accordance with the Examiner's suggestion.

Claims 4 and 8 stand objected to as allegedly being of improper dependent form for failing to limit the subject matter of a previous claim. Claim 4 contains language, "*iron ions by 0.1 gram/liter ... pulse reverse electrolytic plating*," that the Examiner deems to be redundant and not further limiting, and requests that such language be deleted. Applicants have amended claim 4 in accordance with the Examiner's suggestion. Claim 8 contains a limitation that the Examiner deems to be a method limitation that allegedly does not further define the structure of the claimed apparatus. Applicants have amended the claim to place it in proper dependent form by further defining the structure of the claimed apparatus. Accordingly, Applicants respectfully request reconsideration and withdrawal of the objections.

Anticipation Rejection – 35 U.S.C. § 102(e)

Claims 1, 3-8 and 11 are pending and stand rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by Dahms, *et al.* (U.S. Pat. No. 6,099,711). Applicants respectfully traverse the rejection and request reconsideration because Dahms fails to teach every element of the recited claims.

Applicants note that Dahms discloses "a method for electrolytic deposition of fine crystalline metal coatings, by means of a pulse current or pulse voltage method on complex shaped workpieces as cathodes, by using inert insoluble anodes coated with noble metals or oxides of noble metals and forming a deposition solution that contains ions of the metals to be deposited and certain compounds." (Col. 4, ll. 18-24). The depositing solution is stirred "[by] injecting air into the electrolytic chamber." (Col. 9, l. 39).

In light of the foregoing amendments, Applicants respectfully submit that the Examiner's rejection is now moot because Dahms does not disclose all of the limitations of

newly-amended claims 1 and 7. As acknowledged by the Examiner, Dahms fails to disclose the claimed solution that is "stirred to move parallel to the wiring board surface on which a plating layer is generated," as now recited in claim 1. While Dahms briefly mentions a method of stirring the depositing solution, as discussed above, Dahms completely fails to indicate a desired movement of the solution during the stirring. Because Dahms does not recite all the limitations of claim 1, Applicants respectfully submit that Dahms does not anticipate claim 1.

As claims 3-6 ultimately depend from claim 1, Applicants respectfully submit that claims 3-6 are not anticipated by Dahms for the reasons explained above.

With respect to claim 7, Dahms fails to disclose the claimed "stirring unit [that stirs and moves] the plating metal solution in a direction parallel to the wiring board surface on which a plating layer is generated so that microvia holes disposed on the wiring board are filled with metal plating." In contrast, and as discussed above, Dahms merely refers to stirring by air injection, and discloses neither a stirring unit nor the manner in which the depositing solution is to be stirred. Because Dahms does not recite all the limitations of claim 7, Applicants respectfully submit that Dahms does not anticipate claim 7.

As claims 8 and 11 ultimately depend from claim 7, Applicants respectfully submit that claims 8 and 11 are not anticipated by Dahms for the reasons explained above.

Because Dahms fails to recite all the limitations of claims 1, 3-8 or 11, therefore, Applicants respectfully submit that Dahms does not anticipate claims 1, 3-8 or 11.

Claims 1 and 5-8 stand further rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by Senge, *et al.* (U.S. Pat. No. 6,129,830). Applicants respectfully traverse this rejection and request reconsideration because Senge fails to teach every element of the recited claims.

Applicants note that Senge discloses a process of electrolytically depositing copper layers onto, in particular, printed circuit boards. (Col. 1, ll. 4-6). A substrate and anodes that decompose upon electrolytic deposition are brought into contact with a deposition bath, where a power supply causes copper layers to be deposited on the substrate by way of a pulsed current or voltage process. (Abstract; col. 1, ll. 40-44; col. 3, ll. 49-61; col. 4, ll. 51-62).

In light of the foregoing amendments, Applicants respectfully submit that the Examiner's rejection is now moot because Senge does not disclose all of the limitations of newly-amended claims 1 and 7. As acknowledged by the Examiner, Senge fails to disclose the claimed solution that is "stirred to move parallel to the wiring board surface on which a plating layer is generated." In fact, Senge fails to mention stirring at all. Because Senge does not recite all the limitations of claim 1, Applicants respectfully submit that Senge does not anticipate claim 1. As claims 5 and 6 ultimately depend from claim 1, Applicants respectfully submit that claims 5 and 6 are not anticipated by Senge for the reasons explained above.

Likewise, and with respect to claim 7, because Senge fails to disclose stirring of the deposition bath, Senge fails to disclose the claimed "stirring unit." Senge also fails to disclose the claimed "moving the plating metal solution in a direction parallel to the wiring board surface on which a plating layer is generated so that microvia holes disposed on the wiring board are filled with metal plating." Because Senge does not recite all the limitations of claim 7, Applicants respectfully submit that Senge does not anticipate claim 7.

As claim 8 ultimately depends from claim 7, Applicants respectfully submit that claim 8 is not anticipated by Senge for the reasons explained above.

Because Senge fails to recite all the limitations of claims 1 and 5-8, therefore,

Applicants respectfully submit that Senge does not anticipate claims 1 or 5-8.

Obviousness Rejection – 35 U.S.C. § 103(a)

Claims 2 and 9-10 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Dahms as applied to claims 1 and 7 above, and further in view of Schumacher, *et al.* (U.S. Pat. No. 5,976,341). Claims 2 and 9-10 also stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Senge as applied to claims 1 and 7 above, and further in view of Schumacher.

Applicants respectfully submit that Schumacher fails to cure the deficiencies of Dahms and Senge. Claim 1 of the present application includes the feature of stirring the metal plating solution so that it flows in a direction parallel to the wiring board surface on which a plating layer is generated. In the Office Action, the Examiner recognizes that neither Dahms nor Senge describes this specific feature. (Office Action, pp. 9-10). The Examiner, however, suggests that Schumacher teaches a metal plating solution that flows parallel to a surface of a wiring board to be plated at col. 8, ll. 65-67; col. 10, ll. 41-43; and Fig. 3, nozzle below numeral 15.

Applicants respectfully submit that col. 8, ll. 65-67 in Schumacher describe only *filters* that remove residues chemically and/or mechanically. Also, at col. 10, ll. 41-43, Schumacher describes only the flow of the plating solution that passes through the muzzle assemblies and surge nozzles and is separated into two directions: toward anode 5 and toward cathode 6 as shown by arrows 12 and 14, respectively, in Fig. 2. Pump 11 in Fig. 2 merely pumps the plating solution from outlets 4 into container 3. The solution exits pump 11 and is pumped into each of the spaces produced by separation lines 17 in container 3. Fig. 3 in Schumacher shows two pumps 11 and 19. Pump 19 pumps the plating solution that

overflows into outlets 18. Neither pump 11 nor pump 19 stirs the plating solution to cause the solution to move parallel to the circuit board surface to which a plating layer is generated.

Therefore, Schumacher is not related to the claimed feature in which the plating solution is stirred and moved in a direction parallel to the wiring circuit surface. Therefore, the subject matter of claims 1 and 7, from which rejected claims 2 and 9-10 depend, respectively, is neither disclosed nor suggested by Schumacher, Dahms or Senge, taken alone or in combination.

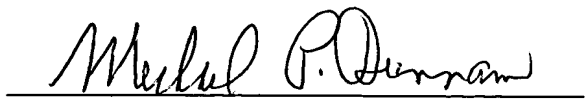
Moreover, with respect to newly-amended claim 2, the claimed adjustment of the flow rate to optimize the speed of copper deposition both on the wiring board surface and inside of the associated microvia holes is neither disclosed nor suggested anywhere in Dahms, Senge or Schumacher. In addition, with respect to newly-amended claim 9, the claimed adjustment of the flow rate of the copper plating solution to bring the iron ion amount present near the wiring board surface to a level at which all the microvia holes are almost fully filled with copper and the copper plating layer thickness on the wiring board surface becomes optimum is neither disclosed nor suggested in Dahms, Senge or Schumacher. Accordingly, Applicants respectfully submit that claims 2 and 9-10 patentably define over Dahms, Senge and Schumacher, either taken alone or in combination.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully submit that the pending claims patentably define over the prior art. Accordingly, a Notice of Allowance is respectfully requested. In the event that the Examiner believes that the present

application is not allowable for any reason, the Examiner is encouraged to contact the undersigned attorney to discuss resolution of any remaining issues.

Date: March 5, 2003



Michael P. Dunnam
Registration No. 32,611

Woodcock Washburn LLP
One Liberty Place - 46th Floor
Philadelphia PA 19103
Telephone: (215) 568-3100
Facsimile: (215) 568-3439

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Please replace the paragraph beginning at line 18 of page 6 with the following rewritten paragraph:

--The technique filling up microvia holes with pulse reverse electrolytic plating is recited, for example, in "Gist of the 100th Lecture" (held on October 6 and 7, 1999) by Surface Finishing Society of Japan.--

Please replace the paragraph beginning at line 3 of page 20 with the following rewritten paragraph:

-- A plating bath which accommodates an insoluble anode and a printed-circuit board, and a copper dissolved bath which supplies copper ions are arranged. The insoluble anode [Is] is arranged as opposed to the printed-circuit board being a cathode, and a forward/reverse current is applied between both of the electrodes. Iron ions are added to a plating solution.--

In the claims:

Please amend the claims to read:

1. (Amended) An electrolytic plating method, comprising:

using a wiring board as one pole, and an insoluble electrode as the other pole; and

performing electrolytic plating by applying a forward/reverse current with the use of a metal plating solution which includes iron ions by [0. 1] 0.1 gram/liter or more and is stirred to move parallel to the wiring board surface on which a plating

layer is generated [,] so that microvia holes on the wiring board are filled up with metal plating.

2. (Amended) The electrolytic plating method according to claim 1, wherein:

the metal plating solution is composed of copper plating solution; and

the flow rate of the copper plating solution is adjusted to a level at which copper deposition speeds both on the surface and inside microvia holes of the wiring board are optimum [is stirred to flow in parallel to a surface to be plated of the wiring board].

3. (Amended) The electrolytic plating method according to claim [1] 2, wherein

the flow rate of the copper plating solution is adjusted to bring the iron ion amount present near the wiring board surface to a level at which all the microvia holes are almost fully filled and the plating layer thickness on the wiring board surface becomes optimum [insoluble electrode is configured by a multi-aperture electrode].

4. (Amended) The electrolytic plating method according to claim 1 wherein:

the insoluble electrode is configured by a multi-aperture metal mesh[; and

the metal plating solution is implemented by a copper plating solution which includes iron ions by 0.1 gram/liter or more, and performs pulse reverse electrolytic plating].

7. (Amended) An electrolytic plating device for a wiring board, comprising:

an insoluble electrode which is an electrode as apposed to a wiring board;

a metal plating solution including iron ions by 0.1 gram/liter or more; [and]

a power source for performing electrolytic plating by applying a forward/reverse current between the wiring board and said insoluble electrode; and

a stirring unit stirring and moving the plating metal solution in a direction parallel to the wiring board surface on which a plating layer is generated so that microvia holes disposed on the wiring board are filled with metal plating.

8. (Amended) The electrolytic plating device according to claim 7, wherein:

the metal plating solution is comprised of copper plating solution; and

the stirring unit adjusts a flow rate of the copper plating solution to a level at which copper deposition speeds both on the surface and inside microvia holes of the wiring board are optimum [microvia holes formed on a printed-circuit board are filled up with pulse reverse electrolytic plating].

9. (Amended) The electrolytic plating device according to claim [7] 8, wherein

the stirring unit adjusts the flow rate of the copper plating solution to bring the iron ion amount present near to wiring board surface to a level at which all the microvia holes are almost fully filled and the plating layer thickness on the wiring board surface becomes optimum [further comprising a stirring unit stirring said metal plating solution to make said metal plating solution flow in parallel to a surface to be plated of the wiring board].